

Strand 2: Data Analysis, Probability, and Discrete Mathematics

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

Concept 1: Data Analysis (Statistics)

Understand and apply data collection, organization and representation to analyze and sort data.

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
PO 1. Formulate questions to collect data in contextual situations.	PO 1. Formulate questions to collect data in contextual situations.	PO 1. Formulate questions to collect data in contextual situations.	PO 1. Formulate questions to collect data in contextual situations.	PO 1. Formulate questions to collect data in contextual situations.	PO 1. Formulate questions to collect data in contextual situations.	PO 1. Formulate questions to collect data in contextual situations.	PO 1. Formulate questions to collect data in contextual situations.	PO 1. Formulate questions to collect data in contextual situations.	PO 1. Formulate questions to collect data in contextual situations.
	PO 2. Make a simple pictograph or tally chart with appropriate labels from organized data.	PO 2. Make a simple pictograph or tally chart with appropriate labels from organized data.	PO 2. Construct a horizontal bar, vertical bar, pictograph, or tally chart with appropriate labels and title from organized data.	PO 2. Construct a single-bar graph, line graph or two –set Venn diagram with appropriate labels and title from organized data.	PO 2. Construct a double-bar graph, line plot, frequency table, or three-set Venn diagram with appropriate labels and title from organized data.	PO 2. Construct a histogram, line graph, scatter plot, or stem-and-leaf plot with appropriate labels and title from organized data.	PO 2. Construct a circle graph with appropriate labels and title from organized data.	PO 2. Construct box-and-whisker plots.	PO 2. Organize collected data into an appropriate graphical representation.
							PO 3. Determine when it is appropriate to use histograms, line graphs, double bar graphs, and stem-and-leaf plots.	PO 3. Determine the appropriate type of graphical display for a given data set.	PO 3. Display data as lists, tables, matrices, and plots.

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									PO 4. Construct equivalent displays of the same data.
PO 2. Interpret a pictograph.	PO 3. Interpret pictographs using terms such as most, least, equal, more than, less than, and greatest.	PO 3. Interpret pictographs using terms such as most, least, equal, more than, less than, and greatest.	PO 3. Interpret data found in line plots, pictographs, and single-bar graphs (horizontal and vertical).	PO 3. Interpret graphical representations and data displays including single-bar graphs, circle graphs, two-set Venn diagrams, and line graphs that display continuous data.	PO 3. Interpret graphical representations and data displays including bar graphs (including double-bar), circle graphs, frequency tables, three-set Venn diagrams, and line graphs that display continuous data.	PO 3. Interpret simple displays of data including double bar graphs, tally charts, frequency tables, circle graphs, and line graphs.	PO 4. Interpret data displays including histograms, stem-and – leaf plots, circle graphs and double line graphs.	PO 4. Interpret box-and-whisker plots, circle graphs, and scatter plots.	PO 5. Identify graphic misrepresentations and distortions of sets of data.

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PO 3. Answer questions about a pictograph.	PO 4. Answer questions about pictographs using terms such as most, least, equal, more than, less than, and greatest.	PO 4. Answer questions about a pictograph using terms such as most, least, equal, more than, less than, and greatest.	PO 4. Answer questions based on data found in line plots, pictographs, and single-bar graphs (horizontal and vertical).	PO 4. Answer questions based on graphical representation s and data displays including single-bar graphs, circle graphs, two-set Venn diagrams, and line graphs that display continuous data.	PO 4. Answer questions based on graphical representations, and data displays including bar graphs (including double-bar), circle graphs, frequency tables, three-set Venn diagrams, and line graphs that display continuous data.	PO 4. Answer questions based on simple displays of data including double bar graphs, tally charts, frequency tables, circle graphs, and line graphs.	PO 5. Answer questions based on data displays including histograms, stem-and - leaf plots, circle graphs, and double line graphs.	PO 5. Answer questions based on box-and-whisker plots, circle graphs, and scatter plots.	
				PO 5. Identify the mode(s) of given data.	PO 5. Identify the mode(s) and mean (average) of given data.	PO 5. Find the mean, median (odd number of data points), mode, range, and extreme values of a given numerical data set.	PO 6. Find the mean, median, mode, and range of a given numerical data set.	PO 6. Solve problems in contextual situations using the mean, median, mode, and range of a given data set.	PO 6. Identify which of the measures of central tendency is most appropriate in a given situation.

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PO 4. Formulate questions based on data displayed in graphs, charts, and tables.	PO 5. Formulate questions based on graphs, charts, and tables.	PO 5. Formulate questions based on graphs, charts, and tables.	PO 5. Formulate questions based on graphs, charts, and tables to solve problems.	PO 6. Formulate predictions from a given set of data.	PO 6. Formulate reasonable predictions from a given set of data.	PO 6. Identify a trend (variable increasing, decreasing, remaining constant) from displayed data.	PO 7. Interpret trends from displayed data.	PO 7. Formulate reasonable predictions based on a given set of data.	PO 7. Make reasonable predictions based upon linear patterns in data sets or scatter plots.
					PO 7. Compare two sets of data related to the same investigation.	PO 7. Compare trends in data related to the same investigation.	PO 8. Compare trends in data related to the same investigation.	PO 8. Compare trends in data related to the same investigation.	PO 8. Make reasonable predictions for a set of data, based on patterns.
PO 5. Solve problems based on simple graphs, charts, and tables.	PO 6. Solve problems using graphs, charts, and tables.	PO 6. Solve problems using graphs, charts, and tables.	PO 6. Solve problems using graphs, charts and tables.	PO 7. Solve contextual problems using graphs, charts, and tables.	PO 8. Solve contextual problems using graphs, charts, and tables.	PO 8. Solve contextual problems using bar graphs, tally charts, and frequency tables.	PO 9. Solve contextual problems using histograms, line graphs of continuous data, double bar graphs, and stem-and-leaf plots.	PO 9. Solve contextual problems using scatter plots, box-and-whiskers plots, and double line graphs of continuous data.	PO 9. Draw inferences from charts, tables, graphs, plots, or data sets.

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Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
									PO 10. Apply the concepts of mean, median, mode, range, and quartiles to summarize data sets.
									PO 11. Evaluate the reasonableness of conclusions drawn from data analysis.

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								PO 10. Evaluate the effects of missing or incorrect data on the results of an investigation (e.g., Susie's teacher recorded a 39 instead of a 93 for her last quiz, what will happen to Susie's average?).	PO 12. Recognize and explain the impact of interpreting data (making inferences or drawing conclusions) from a biased sample.
								PO 11. Identify a line of best fit for a scatter plot.	PO 13. Draw a line of best fit for a scatter plot.
								PO 12. Distinguish between causation and correlation.	PO 14. Determine whether displayed data has positive, negative, or no correlation.

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									PO 15. Identify a normal distribution.
									PO 16. Identify differences between sampling and census.
									PO 17. Identify differences between biased and unbiased samples.

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Concept 2: Probability Understand and apply the basic concepts of probability.									
Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
		PO 1. Name the possible outcomes for a probability experiment.	PO 1. Name the possible outcomes for a probability experiment.	PO 1. Name the possible outcomes for a probability experiment.	PO 1. Name the possible outcomes for a probability experiment.	PO 1. Name the possible outcomes for a probability experiment.	PO 1. Determine the probability that a specific event will occur in a single stage probability experiment (e.g., Find the probability of drawing a red marble from a bag with 3 red, 5 blue, and 9 black marbles.).	PO 1. Determine the probability that a specific event will occur in a 2-stage probability experiment.	PO 1. Find the probability that a specific event will occur, with or without replacement.

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Concept 2: Probability Understand and apply the basic concepts of probability.									
Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
		PO 2. Predict the most likely or least likely outcome in probability experiments. (e.g., Predict the chance of spinning one of the 2 colors on a 2-colored spinner.)	PO 2. Make predictions about the probability of events being more likely, less likely, equally likely or unlikely.	PO 2. Describe the probability of events as being more likely, less likely, equally likely, unlikely, certain, impossible, fair or unfair.	PO 2. Describe the probability of events as being: <ul style="list-style-type: none"> • certain (represented by “1”), • impossible, (represented by “0”), or • neither certain nor impossible (represented by a fraction less than 1). 	PO2. Express probabilities of a single event as a decimal.	PO 2. Compare probabilities to determine the fairness of a contextual situation (e.g., If John wins when two or greater shows after a six-sided number cube is rolled and Joaquin wins otherwise, is this a fair game?).	PO 2. Solve contextual situations using probability (e.g., If the probability of Michelle making a free throw is 0.25, what is the probability that she will make three free throws in a row?).	PO 2. Determine simple probabilities related to geometric figures.
		PO 3. Predict the outcome of a grade-level appropriate probability experiment.	PO 3. Predict the outcome of a grade-level appropriate probability experiment.	PO 3. Predict the outcome of a grade-level appropriate probability experiment.	PO 3. Predict the outcome of a grade-level appropriate probability experiment.	PO 3. Predict the outcome of a grade-level appropriate probability experiment.	PO 3. Predict the outcome of a grade-level appropriate probability experiment.	PO 3. Predict the outcome of a grade-level appropriate probability experiment.	PO 3. Predict the outcome of a grade-level appropriate probability experiment.

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Concept 2: Probability Understand and apply the basic concepts of probability.									
Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
		PO 4. Record the data from performing a grade-level appropriate probability experiment.	PO 4. Record the data from performing a grade-level appropriate probability experiment.	PO 4. Record the data from performing a grade-level appropriate probability experiment.	PO 4. Record the data from performing a grade-level appropriate probability experiment.	PO 4. Record the data from performing a grade-level appropriate probability experiment.	PO 4. Record the data from performing a grade-level appropriate probability experiment.	PO 4. Record the data from performing a grade-level appropriate probability experiment.	PO 4. Record the data from performing a grade-level appropriate probability experiment.
		PO 5. Compare the outcome of an experiment to predictions made prior to performing the experiment.	PO 5. Compare the outcome of an experiment to predictions made prior to performing the experiment.	PO 5. Compare the outcome of an experiment to predictions made prior to performing the experiment.	PO 5. Compare the outcome of an experiment to predictions made prior to performing the experiment.	PO 5. Compare the outcome of an experiment to predictions made prior to performing the experiment.	PO 5. Compare the outcome of an experiment to predictions made prior to performing the experiment.	PO 5. Compare the outcome of an experiment to predictions made prior to performing the experiment.	PO 5. Compare the outcome of an experiment to predictions made prior to performing the experiment.
				PO 6. Make predictions from the results of student-generated experiments using objects (e.g., coins, spinners, number cubes).	PO 6. Make predictions from the results of student-generated experiments using objects (e.g., coins, spinners, number cubes).	PO 6. Make predictions from the results of student-generated experiments using objects (e.g., coins, spinners, number cubes, cards).	PO 6. Make predictions from the results of student-generated experiments using objects (e.g., coins, spinners, number cubes, cards).	PO 6. Distinguish between independent and dependent events.	PO 6. Distinguish between independent and dependent events.

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Concept 2: Probability Understand and apply the basic concepts of probability.									
Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
		PO 6. Compare the results of two repetitions of the same grade-level appropriate probability experiment.	PO 6. Compare the results of two repetitions of the same grade-level appropriate probability experiment.	PO 7. Compare the results of two repetitions of the same grade-level appropriate probability experiment.	PO 7. Compare the results of two repetitions of the same grade-level appropriate probability experiment.	PO 7. Compare the results of two repetitions of the same grade-level appropriate probability experiment.	PO 7. Compare the results of two repetitions of the same grade-level appropriate probability experiment.	PO 7. Compare the results of two repetitions of the same grade-level appropriate probability experiment.	PO 7. Compare the results of two repetitions of the same grade-level appropriate probability experiment.

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Concept 3: Discrete Mathematics – Systematic Listing and Counting Understand and demonstrate the systematic listing and counting of possible outcomes.									
Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
PO 1. Make arrangements that represent the number of combinations that can be formed by pairing items taken from 2 sets, using manipulatives (e.g., How many outfits can one make with 2 different color shirts and 2 different pairs of pants?).	PO 1. Make arrangements that represent the number of combinations that can be formed by pairing items taken from 2 sets, using manipulatives (e.g., How many ice cream cones can one make with 2 different types of ice cream and 2 different types of cones?).	PO 1. Make arrangements that represent the number of combinations that can be formed by pairing items taken from 2 sets, using manipulatives (e.g., How many types of sandwiches can one make with 3 different types of fillings and 2 types of bread if only one type of bread and 1 kind of filling is used for each sandwich?).	PO 1. Make a diagram to represent the number of combinations available when 1 item is selected from each of 3 sets of 2 items (e.g., 2 different shirts, 2 different hats, 2 different belts).	PO 1. Find all possible combinations when 1 item is selected from each of two sets containing up to three objects (e.g., How many outfits can be made with 3 pants and 2 tee shirts?).	PO 1. Find all possible combinations when 1 item is selected from each of 2 sets of different items, using a systematic approach (e.g., shirts: tee shirt, tank top, sweatshirt; pants: shorts, jeans).	PO 1. Determine all possible outcomes involving a combination of 3 sets of 3 items, using a systematic approach (e.g., 3 different shirts, 3 different pairs of pants, and 3 different belts).	PO 1. Determine all possible outcomes involving the combination of up to three sets of objects (e.g., How many outfits can be made with 3 pants, 2 tee shirts and 2 pairs of shoes?).	PO 1. Determine all possible outcomes involving the combination of two or more sets of objects (e.g., If you roll a six-sided number cube 4 times, how many possible outcomes are possible?).	PO 1. Determine the number of possible outcomes for a contextual event using a chart, a tree diagram, or the counting principle.

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Concept 3: Discrete Mathematics – Systematic Listing and Counting Understand and demonstrate the systematic listing and counting of possible outcomes.									
Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
						PO 2. Determine all possible arrangements given a set with four or fewer objects using a systematic list, table or tree diagram when order is not important.	PO 2. Determine all possible arrangements of a given set, using a systematic list, table, tree diagram, or other representation.	PO 2. Determine all possible arrangements given a set. (e.g., How many ways can you arrange a set of 7 books on a shelf?).	PO 2. Determine when to use combinations versus permutations in counting objects.
									PO 3. Use combinations or permutations to solve contextual problems.

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Concept 4: Vertex-Edge Graphs Understand and apply vertex-edge graphs.									
Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
PO 1. Color pictures with the least number of colors so that no common edges share the same color (increased complexity throughout grade levels).	PO 1. Color pictures with the least number of colors so that no common edges share the same color (increased complexity throughout grade levels).	PO 1. Color pictures with the least number of colors so that no common edges share the same color (increased complexity throughout grade levels).	PO 1. Color maps with the least number of colors so that no common edges share the same color (increased complexity throughout grade levels).	PO 1. Color maps with the least number of colors so that no common edges share the same color (increased complexity throughout grade levels).	PO 1. Color maps with the least number of colors so that no common edges share the same color (increased complexity throughout grade levels).	PO 1. Find the shortest route on a map from one site to another (vertex-edge graph).	PO 1. Find the shortest circuit on a map that makes a tour of specified sites (vertex-edge graph).	PO 1. Solve contextual problems represented by vertex-edge graphs.	